

Studies on Effect of Thermal Processing on Preparation of Bael Fruit RTS Blended with Aonla

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Abstract

Bael fruit juice (*Aegle marmelose correa*) and Indian gooseberry or Aonla (*Emblica officianalis*) were optimised to a blended beverage which was stored for 45 days in pet bottles (200 ml capacity) at refrigerated temperature. Physico-chemical and sensory analysis was evaluated. Marginal changes in pH, total soluble solids, acidity and vitamin C were observed. Estimation of vitamin C content of sample (29.61mg) showed high improvement in nutritional value of Bael juice incorporated with Aonla juice. The acidity increased (0.66-1.11) and pH of the juice decreased progressively during the storage period. The mean overall acceptability scores of more than 8 for juice samples up to 40% Bael juice incorporation. The sample (40:60 ratio) of (Bael:Aonla) indicated the commercial scope for manufacturing good and nutritious Bael juice blended with Aonla juice. Heat pasteurization by thermal processing i.e., (90°C for 25 sec) was more effective for inactivating the microbial flora. However the shelf life of juice was established within 45 days. The product is recommended for children, youth and elderly persons to be used within 45 days.

Keywords: Blended beverage, Bael juice, Aonla juice, Thermal processing.

1. Introduction

Production of fruit beverages on a commercial scale was practically unknown till about 1930, but since then it has gradually become an important industry. Fruit-based drinks are far superior to many synthetic preparations and are being replaced by fruit beverages. It would be a boon to the consumers as well as to the fruit growers (Shrivastav and Sanjeev, 1994). Fruit beverages are easily digestible, highly refreshing, thirst quenching, appetizing and nutritionally far superior to many synthetic and aerated

drinks (Sidappa et al., 1986). The medicinal value of Bael fruit is enhanced due to presence of Tannin, the evaporating substance in its rind. The rind contains 20% and the pulp has only 9% of Tannin. This substance helps to cure diabetes.

Bael (*Aegle marmelos*) is one of the most useful medicinal fruits of India. The common name of Bael is stone apple. The tree grows wild in dry forests on hills and plains of India, Burma, Pakistan and Bangladesh; also in mixed deciduous and dry dipterocarp forests of former French Indochina. It contains many vitamins like vitamin C, vitamin A, thiamine, riboflavin, niacin, and minerals like calcium, and phosphorus (Dikshit and Dutt, 1930).

Aonla is richest source Vitamin C. The pulp of fresh fruit contains 600 mg / 100 g of pulp. One tiny Aonla is equal to Vitamin.C value of about two oranges. The fruit is also rich source of pectin as much as 720 mg/100 g nearly 20 times as much as in orange juice (Urmil, 1976). Bael and Aonla both the fruits are popular because of their tremendous nutritional quality.

Juice blending is one of the best methods to improve the nutritional quality of the juice. It can improve the vitamin and mineral content depending on the kind and quality of fruits and vegetables used (De Carvalho et al., 2007). Apart from nutritional quality improvement, blended juice can be improved in its effects among the variables, thus it cannot depict the net effects of various parameters on the reaction rate. Moreover, one could think of a new product development through blending in the form of a natural health drink, which may also be served as an appetizer.

Table 1. Prepare juice blends as per following blending ratios

Sr. No	juice	Blending ratio	Treatment symbol
1	Bael : Aonla	100 : 00	T ₀
2	Bael : Aonla	60 : 40	T ₁
3	Bael : Aonla	50 : 50	T ₂
4	Bael : Aonla	40 : 60	T ₃

2. Materials and Methods

The fully matured, freshly harvested Bael and Aonla were procured from the local market of Allahabad and were brought to the Dept. of Food Process Engineering, Vaugh School of Engineering and Technology of Sam Higginbottom Institute of Agricultural Technology And Sciences.

2.1 Juice Preparation:

The Aonla were washed with tap water, and peeled using sodium hydroxide (40g/l) at 95°C for 1 min then washed again in tap water this was followed by blanching in citric acid solution 60 gm/l at 40°C for 5 min then cool in iced water to inactivate there endogenous enzyme and soften their tissues. At the end, the seeds were removed and grounded with addition of distilled water 1:1 (v/w) and filtered through muslin cloth to get fresh juice. Then the sound quality of Bael were selected and cleaned with tap water. The pulp was extracted and after separation of seeds, Juice was prepared. After that the juice of Bael and Aonla were blended in different ratios of 100:0, 60:40, 50:50, 40:60 respectively then sugar, citric acid were added to juice properly and then mixture was filtered through muslin cloth. After that juice was filled in PET bottles which were sterilized at 110°C for 10 min, then sealed. After that bottles were pasteurized at 75, 80, 85,

90°C for 25 sec respectively. PET bottles were cooled at room temperature and then stored under refrigeration at $4 \pm 1^{\circ}\text{C}$ for 45 days. Total acidity (as % citric acid) and vitamin C were determined by titrimetric method (Ranganna 1986). TSS was determining directly with a refractometer ATAGO (0-500 Brix). Values for pH were measured by pH meter (AOAC 1985). All estimations were carried out in triplicate at 15 days interval and the mean values reported. A panel of 5 semi-trained members carried out the overall acceptance test for the juice 9-point Hedonic scale, where 9 is “like extremely” and 1 is “dislike extremely” as described by (Amerine et. al., 1965) The stastical analyses were carried out by Two- way ANOVA classification as described by (Snedecor and Cochran 1968).

3. Results and Discussion

3.1 Sensory Evaluation:

Sensory evaluation of blended juice during storage was done on the basis of sensory evaluation it was found that the juice sample having ratio of Bael:Aonla(40:60) had highest overall acceptability. Juice sample of different ratio were prepared. Sensory evaluation was done on 9- point hedonic scale. The evaluation of juice was done on the basis of color, taste, aroma, flavor and overall acceptability. The value of different parameters was written on average score and shown below in tabular form and its chart was also prepared where ratio 1, 2, 3 and 4 represent 100:0, 60:40, 50:50 and 40:60 (Bael: Aonla blended juice respectively).The sensory analysis of the control (T₀) and the experiment juice T₁, T₂, and T₃ were done on 9- point hedonic scale with color, taste, aroma, flavor, appearance and overall acceptability as these are the quality parameters.

3.2 Physico-chemical Analysis

3.2.1 Total Soluble Solids

The TSS increased with gradual passage of storage time, which might be due to hydrolysis of polysaccharides into monosaccharide and oligosaccharides. The minimum increase (10 Brix to 13 Brix) in TSS was recorded in T₃treatment, which was statistically superior to other treatments. Similar results were also reported by Deka and Sethi (2001) in juice blends and Deka (2000) found an increasing trend in total soluble solids during storage at ambient and low temperature in lime - aonla and mango-pineapple spiced RTS beverages.

3.2.2 Titrable Acidity

There was a significant increase in titratable acidity content during storage (Table 3). This might be due to the addition of citric acid and increase in the level of Aonla juice. It was observed that maximum acidity (1.21%) was recorded in the Bael juice blended with Aonla juice (100:00) T₀. The minimum increase (1.11%) in acidity was showed in T₃ treatment which might be due to addition of citric acid and increase in the level of Aonla juice as shown in Table 3.

3.2.3 pH

There was a significant decrease in pH during storage (Table 4). This might be due to increase in titratable acidity, as acidity and pH are inversely proportional to each other. It was observed that the maximum pH (4.02) was recorded in the Bael juice blended with Aonla juice T₃. The decrease in pH was due to increase in titratable acidity which affects the organoleptic quality of juice. (Bhardwaj et al., 2005)

3.2.4 Ascorbic acid

The ascorbic acid (vitamin “C”) content of the juice decreased during storage with the advancement of storage period, which was probably due to the fact that ascorbic acid being sensitive to oxygen, light and heat was easily oxidized in presence of oxygen by both enzymatic and non-enzymatic catalyst (Mapson, 1970). Among the beverages prepared with Aonla juice were better in ascorbic acid content. Maximum ascorbic acid (29.61 mg/100 ml juice) was recorded in Bael juice (40%) blended with Aonla juice that is 60 % (T₁). These findings are in conformity with the studies of Jain and Khurdiya (2005) reported that the Indian gooseberry juice contained the highest vitamin “C” (478.56 mg / 100 ml. juice). Hence, when gooseberry juice was blended with other fruit juices for the preparation of blended ready-to-serve beverages, it boosted their nutritional quality in terms of vitamin C content as shown in table 5.

Table 2: Sensory quality scores of Bael juice blend with Aonla juice during storage.

ORGANOLEPTIC SCORE						
Sample	Color	Taste	Aroma	Flavor	Appearance	Overall Acceptability
T ₀	8	6	7	6	8	7.0
T ₁	8	7	7	7	8	7.4
T ₂	8	8	7	8	8	7.8
T ₃	9	9	9	8	9	8.8
F- test	S	S	S	S	S	S
S. Ed. (±)	0.102	0.408	0.125	0.286	0.327	0.204
C. D. (P = 0.05)	0.217	0.870	0.266	0.609	0.696	0.435

Table 3: Titrable Acidity

No. of Treatment	Storage period (Days)			
	0 Day	15 Day	30 Day	45 Day
T ₀	0.83	1.08	1.12	1.21
T ₁	0.74	0.92	1.00	1.13
T ₂	0.70	0.90	0.97	1.07
T ₃	0.66	0.88	0.96	1.11
F- test		NS		
S. Ed. (±)		0.119		
C. D. (P = 0.05)		0.253		

Table 5: Vitamin C content

No. of Treatment	Storage period (Days)			
	0 Day	15 Day	30 Day	45 Day
T ₀	6.50	5.90	4.10	3.40
T ₁	26.02	24.07	21.85	19.08
T ₂	31.05	29.16	28.91	27.05
T ₃	36.03	34.05	32.66	29.61
F- test		S		
S. Ed. (±)		1.621		
C. D. (P = 0.05)		3.452		

Table 4: pH

No. of Treatment	Storage period (Days)			
	0 Day	15 Day	30 Day	45 Day
T ₀	4.50	4.10	3.80	3.21
T ₁	4.10	3.84	3.08	3.0
T ₂	4.09	3.98	3.64	3.15
T ₃	4.02	3.87	3.40	3.30
F- test		NS		
S. Ed. (±)		0.335		
C. D. (P = 0.05)		0.714		

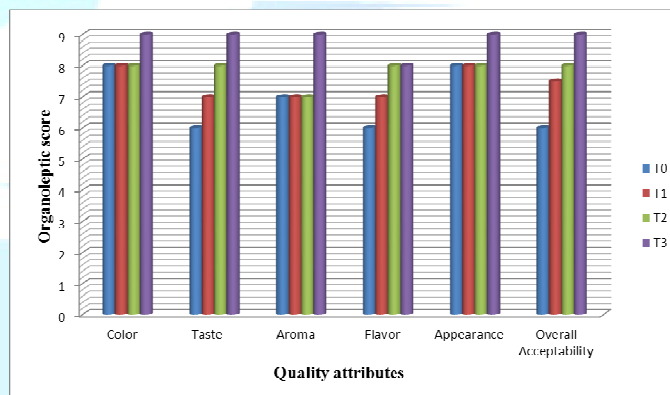


Fig.1 sensory quality attributes of blended juice.

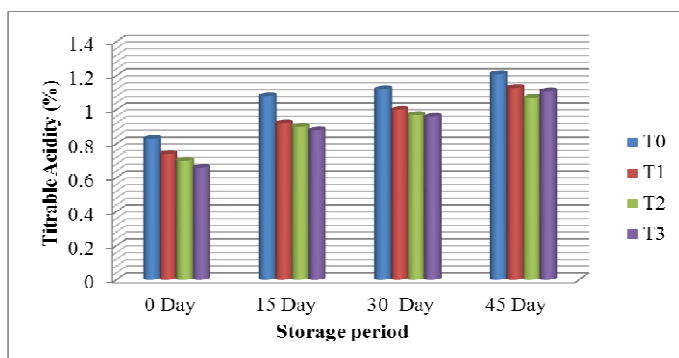


Fig.2: titrable acidity of plain and blended juice during storage period

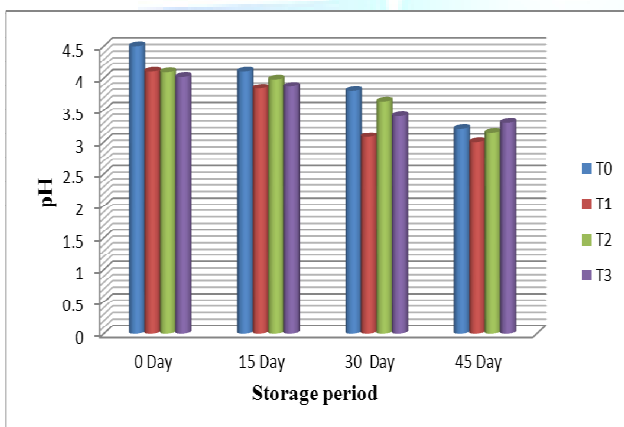


Fig 3: pH value of plain and blended juice during storage period

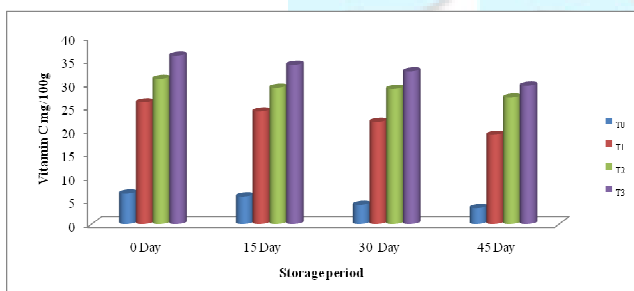


Fig.4: vitamin C content of plain and blended juice during storage period.

4. Conclusion

In the present dissertation, Bael and Aonla blended RTS was prepared considering the nutritional and healthy aspects of both the fruits. Blending was done as Bael: Aonla ratios (100:0), (60:40), (50:50) and (40:60). Thermal treatment was given at 75°C, 80°C, 85°C and 90°C respectively. It was concluded that juice treated at 90°C showed best results regarding the keeping as well as the nutritional quality of blended RTS. The sample (40:60) treated at 90°C was most effective juice blend for minimum change in TSS (10 brix to 13 brix), acidity (0.66-1.11), vitamin C (36.3-29.61) and Sensory evaluation was also higher and better consistency score up to the end of storage. The population of bacteria is less, mold and yeast (9×10^3) at the end of storage 45 days. On the basis of above results revealed in the present study, it can be concluded that the formulation of mixed blend juice beverage is possible to satisfy consumer taste and preferences. The product was microbiologically safe during 45 days of storage with good acceptability. So this juice blend could be stored for 45 days.

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Appendix

Table A.1 ANOVA for titrable acidity.

Source	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result
Treatment	3	0.063	0.0211	0.750110832	3.49	NS
Error	12	0.338	0.0282	-	-	-
TOTAL	15	-	-	-	-	-

Table A.2 ANOVA for pH

Source	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result
Treatment	3	0.327	0.1091	0.485755118	3.49	NS
Error	12	2.694	0.2245	-	-	-
TOTAL	15	-	-	-	-	-

Table A.3 ANOVA for ascorbic acidity.

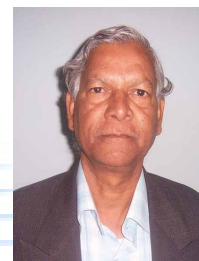
Source	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result
Treatment	3	1848.341	616.1136	117.2925117	3.49	S
Error	12	63.034	5.2528	-	-	-
TOTAL	15	-	-	-	-	-

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